

Introduction:

Keratoconus causes progressive scarring and distortion of the cornea, resulting in poor vision. While contact lenses like sclerals have done much to improve vision for these patients, some still fail to attain best visual potential. Scarring and posterior corneal irregularities can lead to higher order aberrations (HOA) that would limit a patient's vision. Scleral lenses now offer the potential to correct HOAs in some patients.

Case History:

A 26 y.o. Asian male presented for a scleral lens fitting with a history of advanced keratoconus and was an established scleral lens wearer with complaints of deposits and midday fogging. The patient's entering VAs were 20/30 OD and OS.

CL Findings:

Valley Contax Custom Stable Sclerals

Trial #1

OD: BC 43.00/Pwr: -2.00/Diam: 15.8

Fit: Nasal edge lift, central touch

OR -2.75, VA 20/25

9:00/3:00 flat meridian

Change: increase LITe Zone to -1 & central clearance, tighten nasal edge

OS: BC 45.00/Pwr: -4.00/Diam: 15.8

Fit: 400 μ m of clearance, aligned edges

OR -3.00, VA 20/25

8:00/2:00 flat meridian

Change : Decrease clearance 100 μ m w/ 15 degrees rightward rotation

OR -2.50-2.00x055, VA 20/25

Trial #2 lenses ordered with changes

Lens #2

OD: BC 43.00/Pwr: -4.75

Fit: 250 μ m CC limbal clearance, aligned edges

OR: 0.00 -1.00 x 180, VA: 20/25

Plan: Add front toric

OS: BC 45.00/Pwr: -6.50-2.00x040/SL:6/-4

Fit: 250 μ m clearance, aligned edges

OR: +0.50, VA: 20/25

Plan: Dispense final lens

Lens #3

OD: BC 43.00/Pwr: -4.75-1.00 x 180

Fit: 250 μ m clearance aligned edges, VA: 20/25

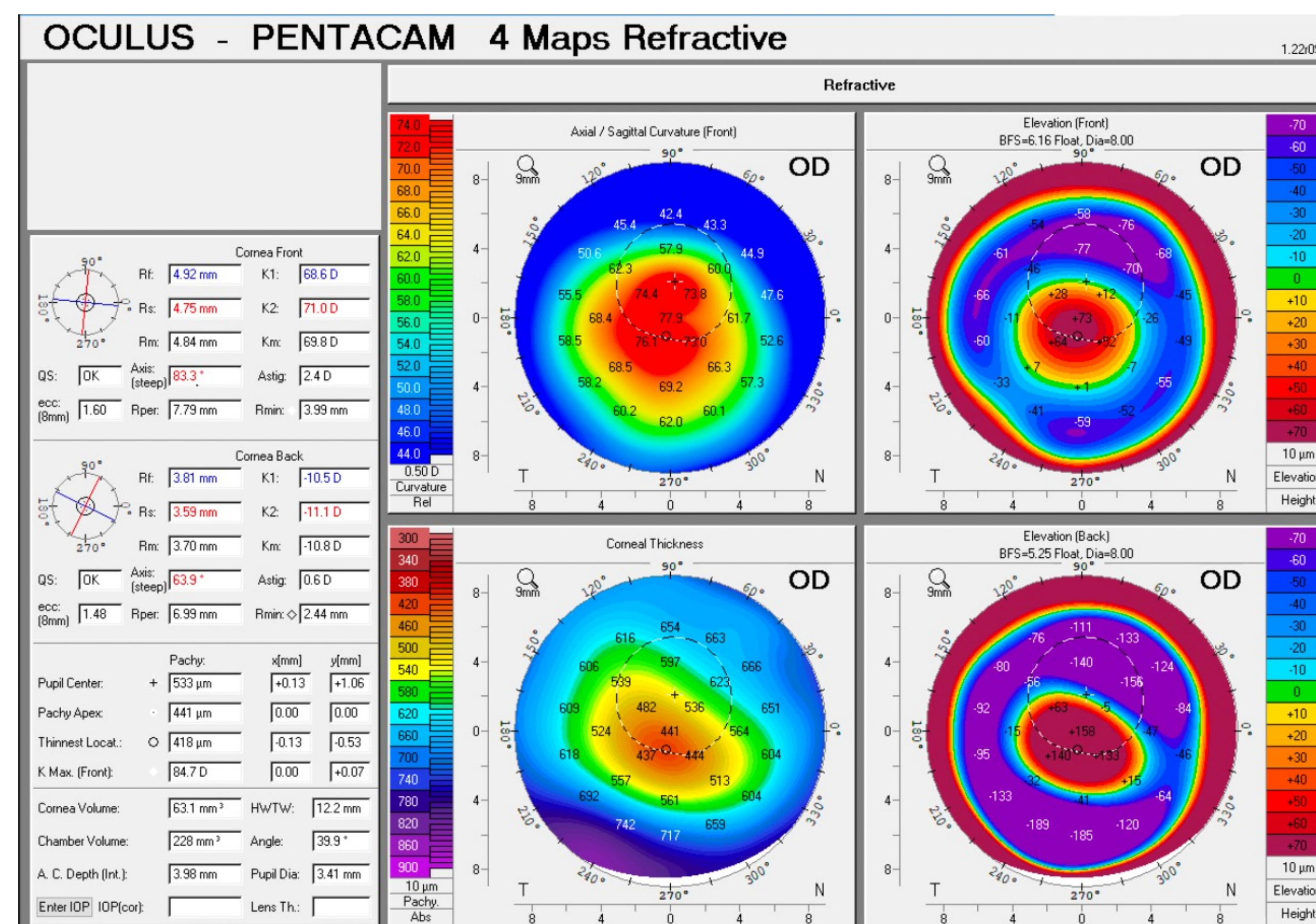
Plan: Dispense final lens

OS: BC 45.00/Pwr -6.00-2.00x040/SL: +6:00/-4:00

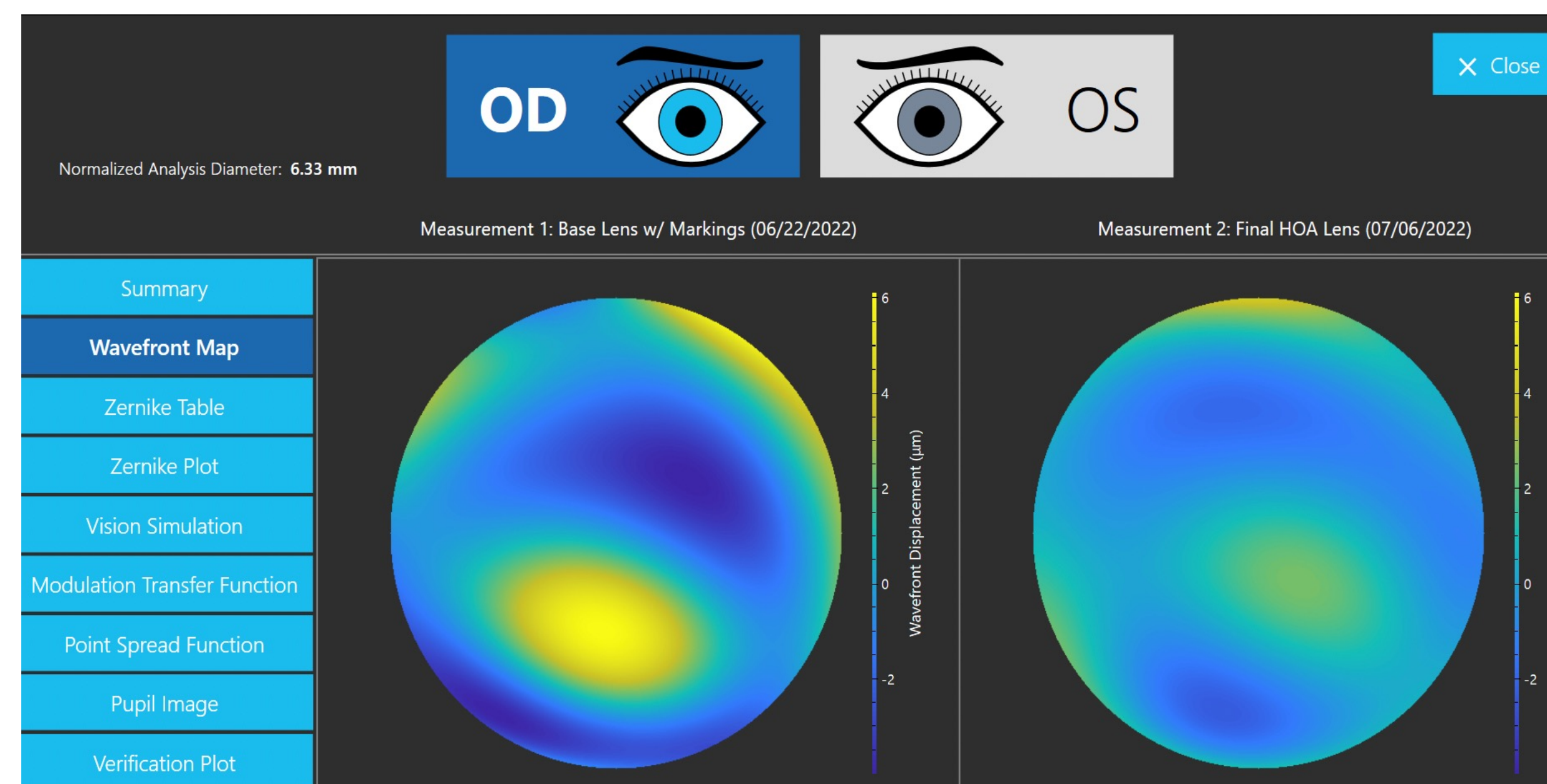
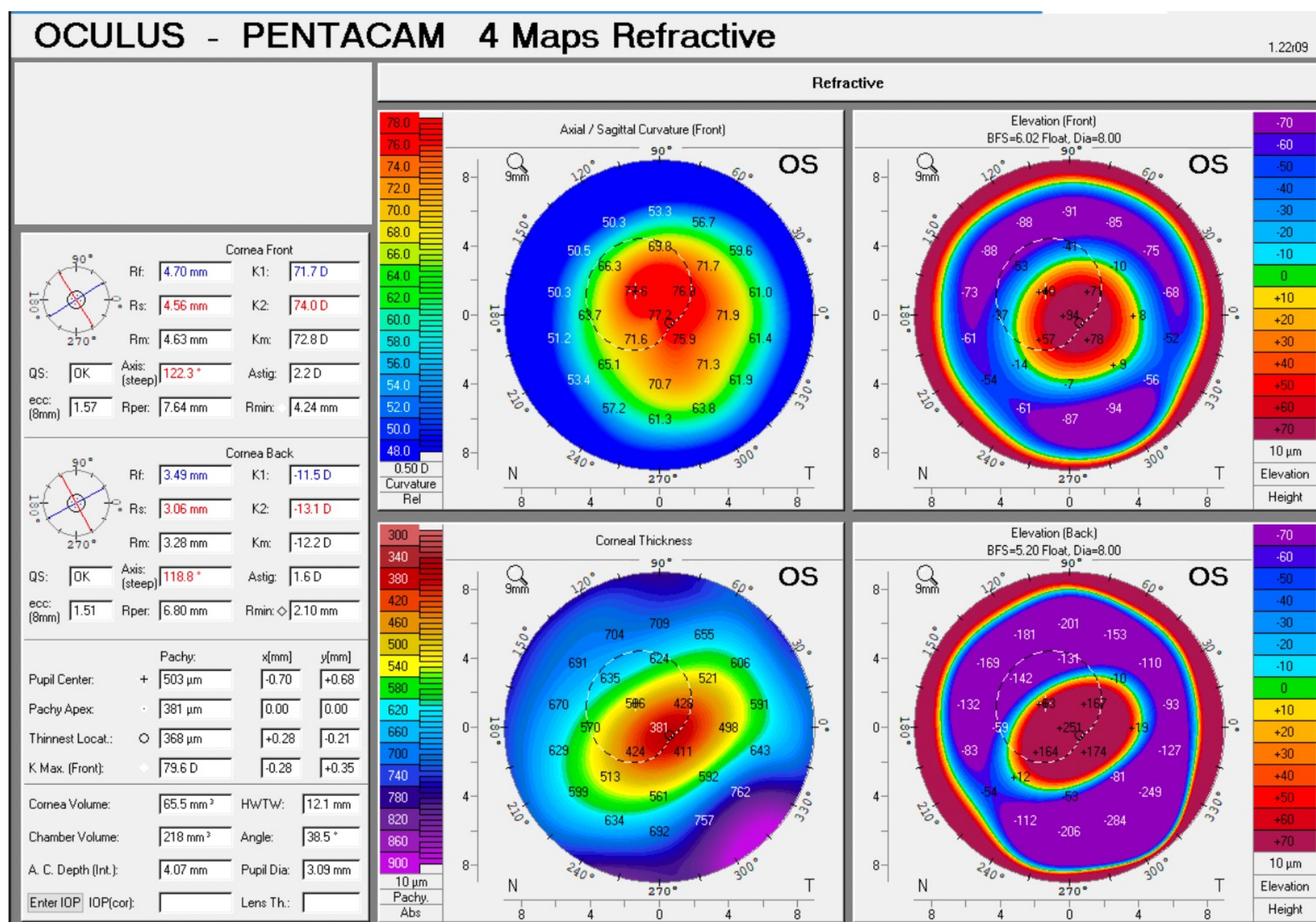
Fit: Fit: 250 μ m clearance, aligned edges

VA: 20/25

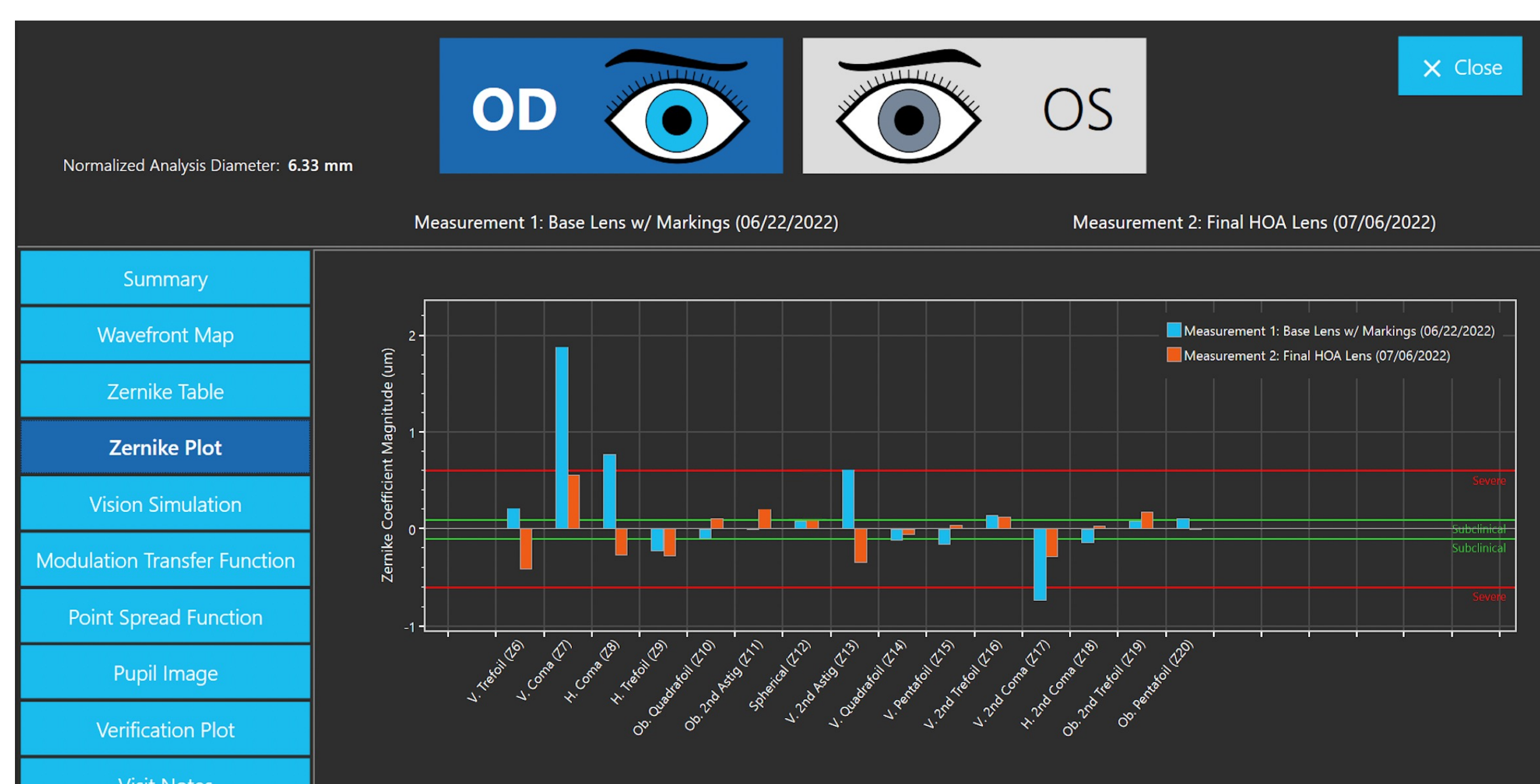
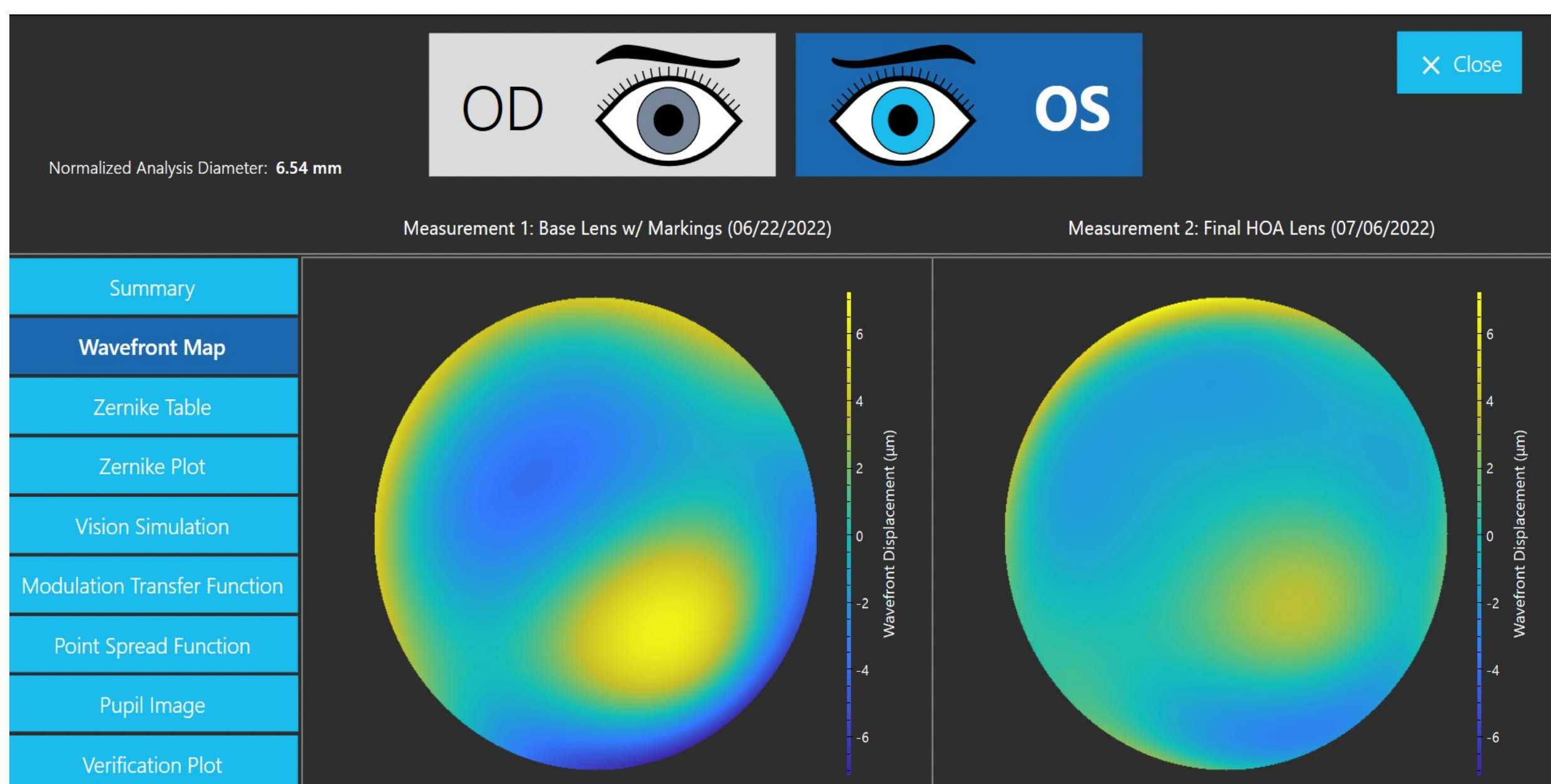
Plan: Dispense final lens



Figures 1 and 2. The above images display the four-map refractive topographic Pentacam measurements for OD (right image) and OS (left image). As seen in keratoconus there are both anterior and posterior corneal integrity changes based on axial curvature and elevation measurements. Keratometry values also range from 44-74 diopters OD and 48-79 diopters OS, with a central steeping pattern.



Figures 3 and 4. The image on the right displays the Ovitz Ares Higher Order Aberration (HOA) Wavefront map for the right eye before and after HOA correction. The image on the left displays the Ovitz Ares Higher Order Aberration (HOA) Wavefront map for the left eye before and after HOA correction. As seen in the left side of both images, HOA are detected in the area of the apex of the cone and align accordingly to the patient's initial cone measurement displayed in Figures 1 and 2.



Figures 5 and 6. The image on the right displays the Ovitz Ares Higher Order Aberration (HOA) Zernike Plot for the right eye with the blue showcasing measurements with the Base Lens prior to HOA correction. The same is true for the image on the left displaying identical information for the left eye. As seen in the above images, high amounts of vertical and horizontal coma were seen in both the right and left eye as well as secondary astigmatism. The values can be seen to surpass the red line, representing a severe aberration that is clinically significant. Red values display the HOA correction with values being at or below the green line representing subclinical levels.

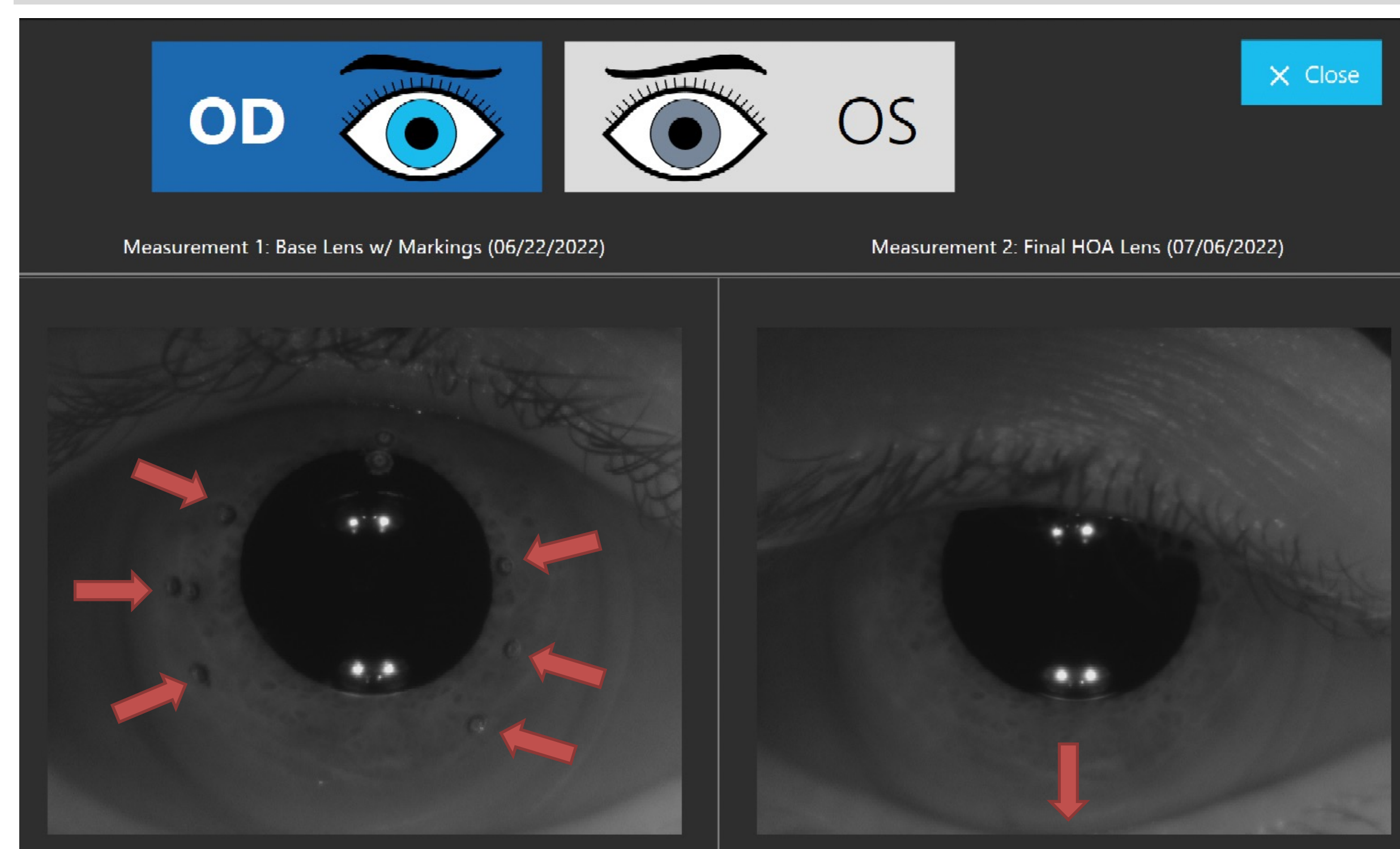
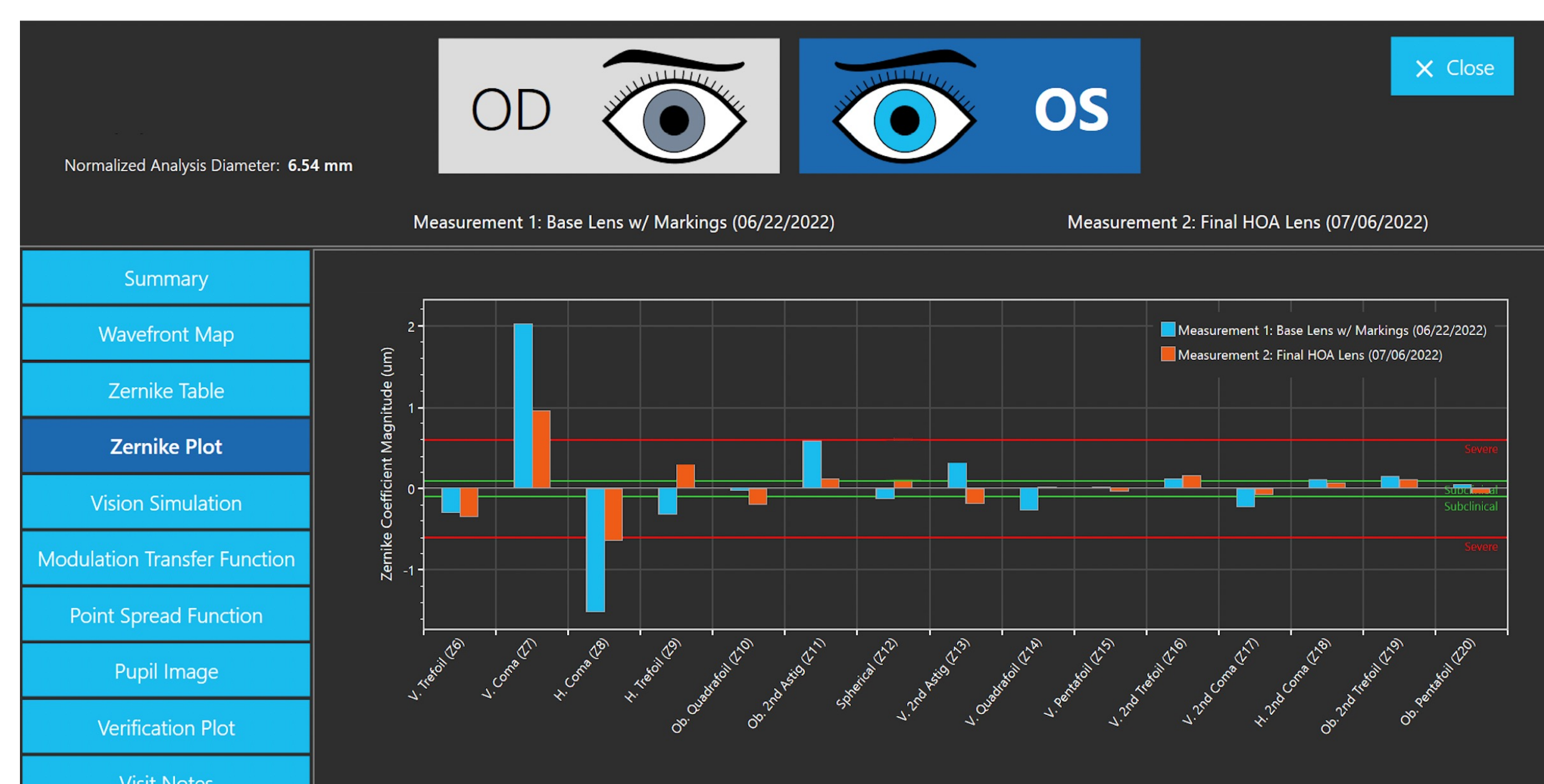
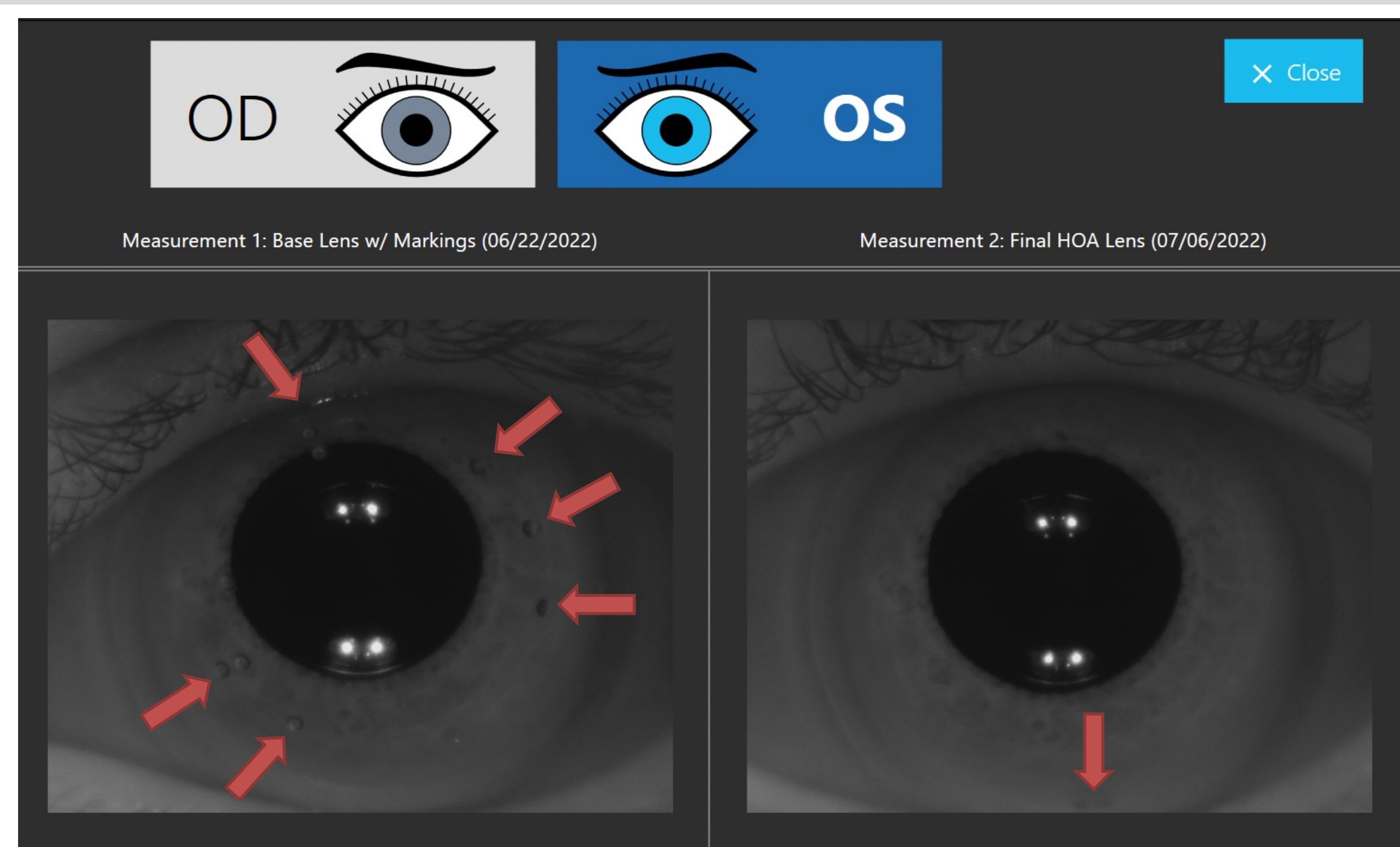


Figure 7 and 8. The image on the right shows the right eye with a Base Lens as the first image and the final HOA scleral lens as the second image. The same is represented for the left eye on the left hand side image. The arrows help highlight the lens markings which help the instrument detect the amount of decentration and in which direction along with the exact amount of rotation. Once HOA correction is fully completed, a non marked lens with a single dot for the right eye and a double dot for the left eye at 6 o'clock is dispensed.



Discussion:

Keratoconus proves to be a difficult corneal ectasia to fully correct. The patient's keratometry values can be seen to be upwards of 70+ diopters in both the right and left eye (Figures 1 and 2). With a central location of the cone, aberrations are definitely present, already limiting visual potential with traditional spectacles and soft contact lenses. Once the patient was fit into a compatible scleral lens brand, this case involving Valley Contax Custom Stable, an ideal fit is achieved with proper lens parameters and over-refraction. It is essential to have a stable scleral lens to determine and eventually place Higher Order Aberration correction in the precise location measured by the aberrometer. Aberrometry is then measured over the pre-HOA lens on eye as seen in the first images in Figures 3 and 4. The yellow coloration helps display the location and amount of higher order aberrations present. A Zernike plot is then determined as seen in Figures 5 and 6 in the blue coloration. Data is sent to Ovitz Ares from the aberrometer to order a base lens with markings (seen in Figures 7 and 8) for the patient. Fully settled scleral lenses are essential for subsequent aberrometer measurements to help determine further corrections that may be needed for residual and underlying higher order aberrations. The base lens with markings help align the aberration measurements for further analysis. Once an endpoint is reached and comparisons are made, a final Higher Order Aberration Wavefront Scleral Lens is ordered for the right and left eye. This final lens will include a single dot for the right eye and a double dot for the left eye to be orientated at 6 o'clock on eye for proper alignment and correction.

Conclusion:

Keratoconus is known to be a corneal ectasia with an inception from the posterior cornea. A traditional scleral lens can help correct a patient's vision by providing a new smooth front surface to focus light. Contrary to the original irregular front surface, Higher Order Aberrations originating from the uncorrected posterior cornea can limit the full visual potential. HOA correction can help further improve the visual potential of a patient that may be left with suboptimal vision from a traditional over refraction and lens parameter changes alone.

References:

Please contact for references and we will be happy to share.